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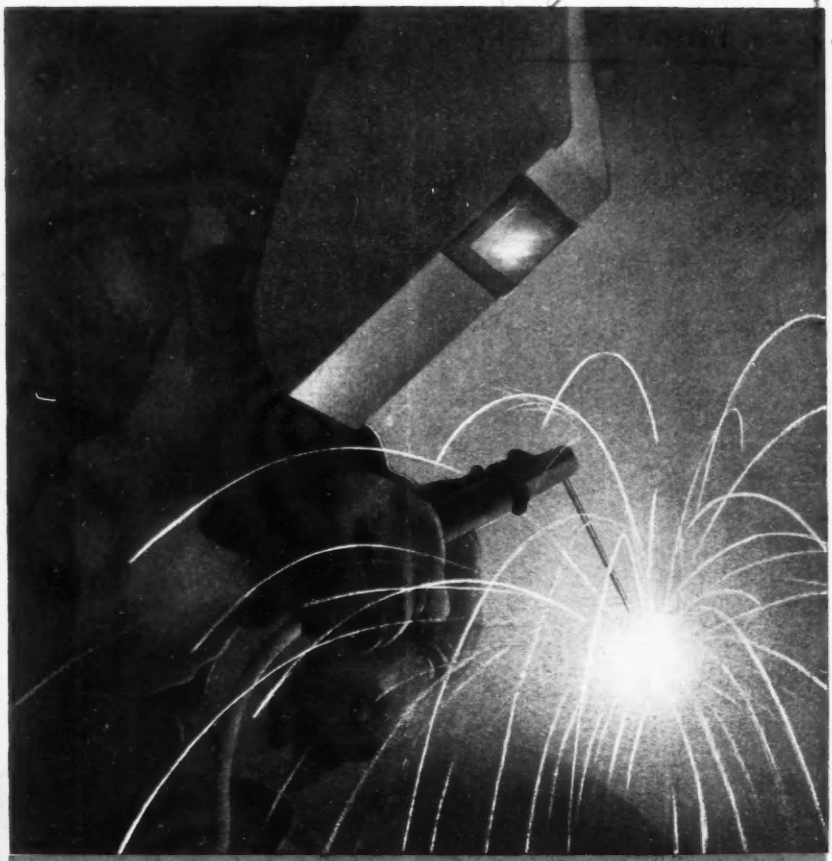

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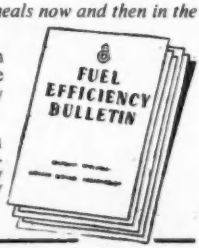

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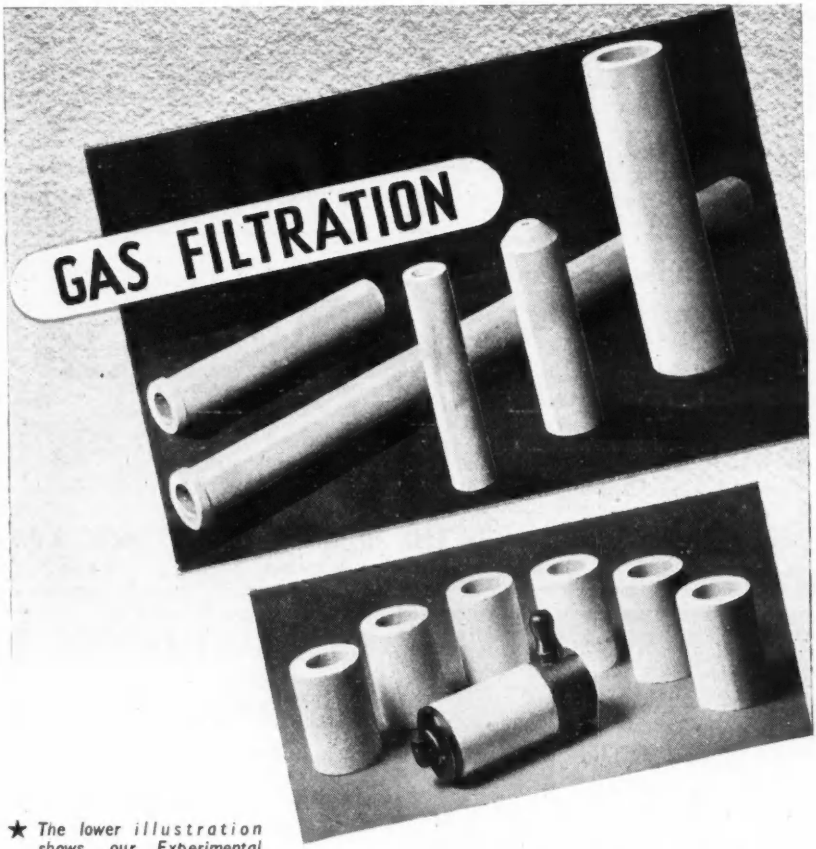

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Angels Unawares

AT the time of the Peninsular War, the British private soldier, stalwart fighter though he was, was far from being a highly-educated mortal. It was, therefore, not the practice of his officers to burden his mind with the plan of campaign, nor to lecture him on the political trends of the day. Nowadays, however, the average soldier takes a real interest in the tactics and strategy of the war, as well as in the political set-up in its widest sense, and—though he may scoff at them as a matter of form—the classes and lectures recommended by ABCA, for example, satisfy a genuine desire for information on the part of Mr. Atkins, and he fights yet better on that account.

Similarly the worker in the factory, however unimportant his position may appear to be, has a good claim, and usually a sincere wish, to understand what is going on in his factory, and how his work fits in with the general scheme of things. Judging by reports we have received, we had thought that the excellent practice of taking employees broadly into the firm's confidence was generally prevalent in the chemical industry, at any rate in all plants claiming to be efficient and up-to-date; but a recent article in *Industrial Welfare*, the organ of the Industrial Welfare Society, casts something of a blight on our optimism. The authors are Dr. Alice Stewart and Miss Mary Lamb, both of the Nuffield Department of Clinical Medicine, Oxford, and the article is a summation of the observations of 20 students, of half-a-dozen assorted universities, who spent six weeks of their vacation working in a large factory, and—what is significant—in a factory of recent construction. The interesting thing about their report is that they were *not* sent to spy upon the factory conditions, but to discover whether a certain chemical produced ill effects on the people who had to handle it. They were merely asked casually to record their general impressions, with the idea that these might be of some use in guiding the practice of industrial welfare in a broad way.

In fact, the recorded impressions did a great deal more than this; they showed up some glaring deficiences in the welfare organisation of this particular factory—defects which, it is clear, went a long way towards causing absenteeism, apathy, and slipshod work. It should be em-

On Other Pages

phasised that these students were not medical students, that they comprised both men and women, and that they worked on the same shifts and observed the same rules as unskilled operatives. They appear to have won the goodwill both of the management and of their co-workers; the latter cheerfully dubbed them "The Guinea Pigs."

Like most other people, they were of the opinion that good welfare work spells good production; and at first glance the welfare in the factory appeared efficient. It soon became apparent, however, that the good results of this efficiency were impaired, if not completely nullified, by the irritation induced by a mass of petty and annoying restrictions, leading to an attitude of cynicism bordering on indifference—with obviously detrimental results on the work done. There is a danger—here and now—of regarding such petty annoyances as inevitable, not only in the factory, but in the life of the nation. A comment on this subject from an outside observer is revealing: Major-General Spears, who recently returned to England from his post as British Minister in Syria, has somehing to say on the matter. "I have a slight feeling," he says, "of having come back to a land run by commissars—of a tendency to discipline the people needlessly, to keep restrictions unnecessarily." Well, we all know the jack-in-office and his little ways, but the trouble is that we are all so inclinded to be good-naturedly lazy that we tend to adopt the attitude of cynicism and indifference, instead of putting our petty bureaucrats in their place.

In the factory then, as in the nation, this gratuitous whip-cracking has the worst of results. One of the most infuriating features observed by our students was the presence of an inspectorate who appeared to do little or no work. We are fully aware that in many war factories the products have to be checked and counterchecked, but the higher management should keep a close watch on the checking staff lest inspection should degenerate into nagging. The higher authority should perform, in the factory, the duty that devolves on Parliament at the national level: "to keep an eye on the commissar spirit," as General Spears puts it, "and see that it is not allowed to spread." In the factory described, there appeared to be, among the workers, no knowledge of the right person to approach in order to remedy the trouble, whereby the sense of frustation was further aggravated.

The products handled in this factory were a potential danger to the workers, and an even greater menace if allowed to leave the factory in a faulty condition in any respect. Yet little or nothing was done to familiarise the workers with the possible consequences of carelessness. Knowing the effective use of posters, pictures, and films that has been made at certain chemical and metallurgical works, we are frankly aghast that such simple means were not used in this instance. Finding that most of their questions about the work they were doing went unanswered by the junior officials, the students approached the higher authority and were given a special lecture on the nature and uses of the products with which they were engaged. Furthermore, they were taken on a tour of the whole factory and shown the relation between the various processes employed. For this, they were an object of envy on the part of those operatives who had not yet sunk so far into apathy that they did not care whether they were making high explosive or high-heeled shoes. With modern large-scale production and division of labour, it becomes more and more obligatory to attempt to interest workers in what they are doing, and to give them a sense of pride in their contribution to the completed task.

The average British worker tends to be dumb and undemonstrative; it may be through sheer indifference, fear of losing his job, or dislike of a possible rebuff from a petty official. Any dissatisfaction expresses itself in inferior work. Our "angels" were capable of expressing themselves, and in a position to do so; and it was a good job for this particular factory that they did.

We have often advocated the employment of students in factories in their vacations, but this was rather for the good of the students and for the future benefit to technical industry as a whole. It now appears that there is yet another service which this system can perform: the actual amelioration of current works practice and personnel management.

NOTES AND COMMENTS

Science and Industry

THE British Association is to be congratulated for having convened a two-days' conference on "The Place of Science in Industry," which was addressed by the Ministers of Labour and of Reconstruction, as well as by a number of leading scientists and industrialists, dwelling on subjects which ranged from the vitamin industry to the Rolls-Royce Merlin engine. The objective of the conference was to make the public generally, and industry in particular, more conscious of the importance of the interplay between science and industry. Mr. Bevin, presiding at the opening session, emphasised that both a greater effort and a larger outlay were required on research and development in the days to come. "Monopolistic tendencies and cumbersome protective patent laws which were even more restrictive than tariffs" are serious obstacles to change, thus preventing the benefits of scientific discoveries from being enjoyed by the "common man." There is little justification for elation if we ponder over what Lord Woolton said in a forceful speech at the concluding session. Britain was, in fact, saved from starvation during the war by the application of scientific knowledge to food policy. Research work on penicillin would, in peace-time, have taken "many more years."

Improvement in Research

OUR national policy during this century brought us very near to defeat because we were niggardly in supporting our scientists, who are no less brilliant than those of other lands. This applies not merely to pure research carried out, in the main, in the universities, but also to the application of science in almost every sphere of life, be it preventive medicine, housing, food, or fuel. It was only when the results of research were not left to the "tender mercies of the casual commercial passer-by" that an improvement could be expected. However, we must not expect that a more lavish expenditure would, by itself, result in a golden age for science; this could be brought about only by a profound change in the attitude of industrialists—especially of those owning small or medium-sized units—together with a vastly improved scientific education. It would have been rather more encouraging if the audience had included rather more of the type of industrialist at whom the discourses were aimed.

Chemical Engineers' Courses

ALL our readers will be glad to learn that the Institution of Chemical Engineers has published its Scheme for a Degree Course in Chemical Engineering. There can be no doubt that the control of processes and the design of plant is going to be of paramount importance in the days after the war, and the more encouragement that can be given to those who are going to control the processes and design the plant, the better for the community in general. It is admitted that the schedule of subjects set out lays a heavy burden on both teachers and students, and a minimum of four years is prescribed for the course. This is unavoidable: the task of the chemical engineer is no light one, as, in addition to a mastery of the practice of his subject, he must have the ability to define, analyse, and solve problems. The first year's course consists of a general training in mathematics, mechanics, chemistry, physics, and engineering drawing. In the second and third years chemistry again bulks large, and mathematics and drawing are continued, while the properties of materials are studied in detail.

Specialisation

IMPORTANT fourth-year subjects are the study of unit operations and chemical plant design, and the actual methods of works practice come into the picture. It is not until *after* the fourth year that the student is expected to specialise and write himself down an Oil Technologist, a Fuel Technologist, or whatever he may desire; and at all stages it is insisted that the course shall not be unduly rigid, so that if he wishes, the student can transfer his attention in the early stages to some other branch of learning. The course is to be regarded

as an integrated scheme of education in those branches of science which form the basis of chemical engineering, and, when passed, should satisfy the Institution in any claim for exemption from the Associate-Membership examination.

Petroleum Chemists Wanted

TO judge by the wording of an advertisement in a recent issue of *The Times*, it seems as though the foundation of a British organic chemical industry based on oil were within reasonable distance of becoming an accomplished fact. It is stated, in the advertisement, that a British oil company, at its refinery in N.W. England, has three vacancies for chemists in the research and development department. All are required to have some knowledge of petroleum products from various angles, and the nature of the knowledge required appears to indicate a wise distribution of the methods that it is contemplated employing in the development work on hand. The "senior research chemist," for example, who is to supervise research on products and processes, must have "experience in manufacture of or research on petroleum products": of his two juniors, one should have chemical engineering qualifications, while of the other is demanded laboratory experience in petroleum or heavy chemicals—in either case for research and development work on petroleum products and processes.

Oil-Based Chemicals ?

IT certainly looks as though this British oil company meant business, and business on the site, not at some out-of-the-way location overseas. An allowance for delay in taking up the posts, in the case of candidates at present occupied with national service requirements, is, of course, included; and there should be no difficulty in finding suitable men to fill the positions. That oil-based organic chemical industry, the foundation of which we, among others, have so often urged, looks as though it had a good chance of coming into being. It even appears as if some independent spirits had actually learnt a lesson from the war. We shall watch for subsequent developments with the greatest interest.

New Control Orders

Export Licensing

UNDER the existing Export of Goods (Control) Orders, *all* goods require licences on export to certain destinations.

The Export of Goods (Control) (No. 1) Order, 1945 (S. R. & O. 1945, No. 12), operative from January 15, removes from the list of destinations referred to above all countries except: Andorra, Burma, China, Liechtenstein, Portugal (including Madeira, the Azores and the Cape Verde Isl.), Rio de Oro, Spain (including the Canary Isl. and Spanish Morocco), Sweden, Switzerland, Tangier Zone, Turkey, U.S.S.R., and enemy territories. The main effect is to free most Middle East countries from this restriction.

At the same time modifications have been introduced into the system of control over imports into the Middle East, and details of these are now available. The main effect of these is that a recommendation from the Middle East Supply Centre (M.E.S.C.) will not be required in support of an application for export licence except for goods included in the following list.

Among the goods requiring M.E.S.C. recommendation are the following: Dextrose and glucose, essential oils, pectin, saccharin, soap, starch and inedible starch products, vitamins and vitamin oils and concentrates, casein, paraffin wax, mica and manufactures thereof, lead and manufactures thereof, molybdenum wire, tin and manufactures thereof, tungsten, tungsten carbide and manufactures thereof, analytical balances, vacuum pumps (1 micron or higher vacuum), rubber and synthetic rubber, balata, gutta-percha and manufactures thereof.

Acetic acid (*not* including vinegar), acetic anhydride, acetone, ammonium nitrate, ammonium phosphate, ammonium sulphate, anhydrous ammonia, aniline oil and aniline salts, argols and wine-lees, arsenious oxide, butyl acetate, butyl alcohol, calcium arsenate, calcium carbide, carbon bisulphide, carbon black, carbon tetrachloride, chlorine, chromic acid tanning compounds, citric acid and citrates, coal-tar dyestuffs, codeine and salts, cresols and cresylic acid, DDT, diacetone alcohol, dichlorodifluoromethane, dicyandiamide, diphenylamine, emetine and salts, ethyl alcohol, formaldehyde, lead arsenate, lead chrome pigment, nicotine sulphate, nicotinic acid, Paris green, penicillin, phosphorus, phosphoric acid, and phosphates, phthalic anhydride, potassium bichromate, potassium chlorate, potassium perchlorate, pyrethrum flower and extracts, rotenone and derris, sodium arsenate, sodium arsenite, sodium bichromate, sodium chlorate, sodium nitrate, sodium silicate, tanning materials, tartaric acid and tartrates, toluol and toluene, urea.

Solvents and Plasticisers

Notes on Recent Trends

by W. E. CASH, M.Sc., A.R.C.S., D.I.C., M.I.Chem.E., A.R.I.C.

THE outlook in this field has slowly changed. After the thousands of experiments in the use of all sorts of various and complicated solvents and, more particularly, plasticisers, the cold reasoning of the supply position has had a sobering effect. The tendency now is to fix upon products which have good all-round properties and for which the raw materials are available, or in the course of being made available, and to standardise and improve where possible. In many cases there is still a shortage of plasticisers, although this deficiency is slowly being amended as far as plant and labour will allow. This, of course, refers to materials of a strictly essential nature. On the other hand, a feeling of optimism on the course of the war is making many people look ahead to urgent civilian supplies, with the object of finding indigenous or more easily obtained solvents which can best serve the lacquer and plastics trade without affecting priority demands.

The Search for the Ideal

The search for the ideal solvent and the perfect plasticiser is still going on, and to this end it has been realised that in very few cases is much fundamental information available. Many workers are investigating the problem of shedding light on the mechanism of solution and plasticisation, and, while a very large volume of work relates to the newer polymers, attention is also directed to old favourites such as the cellulose esters[1], [2], for, in spite of many years of use, there is much to learn. The "activity factor" of solvents for cellulose esters has been dealt with in a paper recently reported[12], liquids with a high factor being suitable for the nitrate and with a low factor for the acetate. Calculation of the factor is made by dividing the square dipole moment by the product of permissivity and surface tension. What is also required, as much as knowledge of the solution process, is an idea of how the reverse works, that is film formation[1]. Various investigators have measured the viscosity of solutions compared with concentration, and from these data have obtained an indication of relative merits of solvents and plasticisers. The effect of solvents on the orientation of polystyrene molecules has been studied. There seems to be an earnest demand to try and find some simple tests whereby any given material can be quickly evaluated as a solvent or plasticiser, but this at present is far from practicable. When one remembers that a plasticiser must have good compatibility (with extenders if necessary) and excellent mechanical, physical and electrical properties over a wide range of atmospheric conditions, the prospect of simple evaluation appears remote at present.

Striking developments in the solvent field are perhaps less noticeable than is the case with plasticisers, but an item of interest is the increasing use of water, either as a solvent or medium for suspension. Cases in point are aqueous solvent for cellulose ethers[3], [4], sodium derivatives of cellulose ethers and polyvinyl alcohol with its ethers, some esters and salts[5]. Attempts are also being made to incorporate in aqueous solution components which are normally insoluble. With water as a medium, certain resins are supplied for use in coatings or impregnations, as, for example, with polyvinyl chloride latex and lacquer, water emulsions using methyl cellulose with urea formaldehyde resins[6].

Furan derivatives are receiving attention in America. Dimethyl furan is suggested as a diluent for nitrocellulose lacquers and a solvent for polyvinyl acetate. Furfural continues to be of use in solvent extraction and the refining of petroleum oils. Furfuryl alcohol is a solvent for nitrocellulose, dyes and resins, is of use as a paint, varnish and lacquer remover, and has good wood-penetrating power[7]. A tetra-substituted hydrofuran is claimed to be a useful solvent for cellulose esters and ethers[8]. Tetrahydrofurfuryl esters are being tried as plasticisers: the oleate is compatible with polyvinyl chloride[9], for which tetrahydrofurane is a solvent.

Nitroparaffins

The production of nitroparaffins is still on a "small scale" (American), but their use as cellulose acetate, triacetate, and acetobutyrate solvents is likely to increase the use of these products. 2-Nitrobutanol is an excellent solvent for zein, and is said to be superior to 90-95 per cent. alcohol and Cellosolve. Nitroparaffins can be used with rubber latex to improve coatings by dipping and moulding. With vinyl resins, nitroparaffins are unsuitable for polyvinyl acetate, polyvinyl chloride or polyvinyl butyral, but have possibilities with finishes of chloride acetate co-polymers.

Higher Alcohols

The production of higher alcohols has received an impulse, mainly for esterification, but many of them are suitable as solvents or in solvent blends for specific purposes.

Ethyl butanol is useful in synthetic resin varnishes and as a flotation agent, while its

acetate gives smooth high-gloss films with nitrocellulose lacquers. The ethyl butyl ether of ethylene glycol has been made as a high-boiling solvent for synthetic resin lacquers. Normal hexyl alcohol is produced in a limited supply and is a solvent for hydrocarbons, linseed oil, shellac, gums, and dyestuffs. Ethyl hexanol, *n*-octyl alcohol, and capryl alcohol are being made, although there is little opportunity to obtain these in view of their use as plasticisers in ester form.

The range of substituted glycols is being increased and polyethylene glycol and its ethers have uses as plasticisers, although resistance to water is not high[10]. Methoxytriglycol acetate[11] is a high-boiling, non-hygroscopic solvent for cellulose esters and certain synthetic resins suggested for coatings and printing-ink compositions. Polyethylene glycols in liquid form are suggested as plasticisers, lubricants, and binders. Polyethylene glycol diethyl hexoate, as Flexol 4 GO, has been added to the range of similar esters, and is claimed to be an efficient plasticiser of low volatility and good flexibility for several plastics.

New polyhydroxy bodies are being developed, although their use as solvents or plasticisers is at present overshadowed by service in other directions; ethylhexanediol, 2-methyl-2, 4-pentanediol and trimethylolpropane are being made in America.

Solvent Esters

Few new esters have been suggested for use as solvents, although with the shortage of the usual solvents some users are turning towards some of the older esters, such as diethyl carbonate, diethyl oxalate and even ethyl acetoacetate, for nitrocellulose lacquers. Oxalates can be used without hydrolysis, provided that care is taken to exclude water from formulations; aromatic hydrocarbons should be used as diluents. Propylene laurate is a recent development in America as a high-boiling solvent. Methyl formate has been made from formaldehyde[13] and formic esters of the mono ethers of polyhydric alcohols are made by the action of carbon monoxide on the ether[14].

Chlorinated Hydrocarbons

Some additions have been made to the range of chlorinated hydrocarbons. Isopropyl trichlorbenzene, chlorpropane (liquid), monochlortoluene, and orthodichlorbenzene are suggested as high-boiling solvents for various resins, while chlorpropane (wax) and highly chlorinated paraffin are said to be useful fire-resisting plasticisers.

Considerable attention continues to be given to the plasticisation of polyvinyl chloride, co-polymers of vinyl chloride and acetate, and vinyl acetals. The rush to try the effect of any handy chemical as a plasticiser has abated somewhat, with manipulators standardising on a short range of plasticisers depending on the use and method of application. Among materials suggested more recently as plasticising P.V.C. are the following: dibenzyl sebacate, tritolyl phosphate, alkyl adipates[15], dicyclohexyl itaconate[16], methyl pentachlorstearate, polyethylene glycol diethyl hexoate (Flexol 4 GO), acetoxy stearates[19], thiodiglycol esters[24], glyceryl tributyrate, ethyl cinnamate, Hycar O R 15, glyceryl triacetoricinoleate, and esters of poly-acids and poly-alcohols (Paraplex G25).

Dihexyl, and more particularly dioctyl phthalate, are the most satisfactory plasticisers that are available in any quantity, having a good compatibility with P.V.C. and giving resistance to water extraction, good low-temperature flexibility coupled with low aging loss, stability to heat and light, and very useful electrical properties. Butyl acetyl ricinoleate gives low-temperature flexibility, while dibutyl and dioctyl sebacate are excellent in this respect, although the electrical properties fall short of the phthalates. Dibutyl sebacate is used to plasticise polyvinyl butyral resins and cellulose acetate in laminated glass[25 26], and with Neoprene to reduce brittle fracture temperature.

Standardising Plasticisers

There is now a general feeling towards standardisation of plasticisers where possible, and also attempts are being made to correlate physical properties of P.V.C. compositions with chemical properties of plasticisers. Generally, this is not so simple as it sounds. There are, for example, several octyl phthalates, the main one at present being made from ethyl hexanol. These esters are similar in their effect, but have certain individual characteristics making standardisation difficult. The actual chemical constitution of butyl acetyl ricinoleate is, no doubt, uncertain owing to the difficulty of obtaining any hydroxy acid of this nature in a pure state. These matters will, in due course, be cleared up, especially when there is a proper relation between supply and demand.

Polyvinyl chloride pastes are made with various solvent plasticisers, such as tricresyl phosphate, dibutyl, amyl, or hexyl phthalates. Solvents for polyvinyl chloride are still very few, only powerful solvents such as mesityl oxide, isophorone cyclohexanone and nitrobenzene being suitable. Most other vinyl resins, which include those of vinyl acetate and alcohol, vinyl acetals, and co-polymers of vinyl chloride and acetate, are more easily dissolved in the usual ketone, ester, and other solvents. Polyvinyl chloride cements can be made with a plasticiser, such as dibutyl phthalate, and mixed with graphite or powdered asbestos. The plasticisation of Formvar is not too easy, as most single plasticisers fail to give rubber-like

products. Mixtures such as diacetin and dibutyl phthalate are more suitable. Dibenzyl ether gives good results.

In view of the shortage of plasticisers, the use of high-boiling hydrocarbons as extender plasticisers has interested many people for P.V.C. and synthetic rubbers. Electrical properties of these materials are naturally good by virtue of their non-polar constitution, although appearance and handling difficulty may be a drawback. Patents deal with a rubber plasticiser made from petroleum feed oil[20], a P.V.C. plasticiser consisting of viscous high-boiling hydrocarbons[21], and methyl isopropyl benzene as a chlorinated rubber solvent[22]. Proprietary materials put forward include H.B.40 for P.V.C., polystyrene, and methacrylates; Prenene I suggested for P.V.C., but not yet proved; Circosol 2 × H as softener and plasticiser for GR-S. Mention should, perhaps, also be made of some American products with claims as plasticisers: Ridbo 369 shows promise as a strengthening plasticising agent for GR-S[23]; P.H.O. appears useful in giving a rubbery product with cellulose acetate, and can replace a proportion of plasticiser; Paraplex G.25, a saturated polyester, comparable with vinyls, nitrocellulose and synthetic rubbers; Bunatak, for GR-S; and Resinex for most rubbers.

Rosin Products

Natural rosin is being used as a source of plasticisers. Hydroabietyl alcohol, the alcohol corresponding to abietic acid, is a viscous sticky liquid, chemically stable, and can be used to plasticise vinyl resins as well as ethyl cellulose, nitrocellulose, and chlorinated rubber. It can also be used as a resin modifier, tackifier, and adhesive modifier. Dihydromethyl abietate, polymerised rosin, and mono-, di-, and triethylene glycol esters of hydrogenated rosin are suggested as softeners or plasticisers.

In spite of the time of necessity spent in examining plasticisers for new resins, the commercial mind has to be awake to the fact that nitrocellulose is still a breadwinner. Owing to the shortage of phthalates, phosphates, and raw materials for the more usual solvents, thoughts are turning towards more available chemicals. The use of citrates, oxalates, stearates, esters of rosin acids, and hydrogenated rosin as plasticisers is suggested, while formates, lactates, and oxalates are possible as solvents. Several papers and patents have dealt with the reduction of fire hazard with nitrocellulose coatings and plastics. For example, a mixture of tricresyl phosphate and magnesium ammonium phosphate is said to have a good effect[17], while zinc chloride, stannous chloride and similar salts have been incorporated in liquid plasticiser compositions containing glycol ethers and phthalates, phosphates, tartrates, etc., to impart fire resistance[18].

Nitrocellulose lacquers are still outstanding in their properties of easy application, good flow, rapid hardening, high gloss, compatibility with resins, and low cost. Their lasting power may be less than other types, but is long enough for most purposes. An improvement will, however, have to be made in increasing the solid-liquid ratio, and this can be done by means of spraying with hot solutions. Hot-spray technique[27] requires the use of rather higher-boiling solvents than those usually used; butyl and amyl acetates replace ethyl acetate; hexyl acetate may be suitable.

Acetates

Cellulose acetate, cellulose triacetate, and cellulose acetobutyrate are capable of producing clear, tough, transparent films, giving freedom from inflammability, and durability in clear coats. Although lacquer of this type may not be able to compete with nitrocellulose lacquers owing to poor resin compatibility, limited solubility, water absorption, and higher cost, there are special purposes for which cellulose acetate, and more especially cellulose acetobutyrate are superior. Nitroparaffins are excellent solvents, and the acetate solutions have a good tolerance for diluents. 1-Nitropropane and 2-nitropropane have evaporation rates similar to that of butyl acetate, and enable cellulose acetobutyrate lacquers to be made having evaporation rates, flow, and blush-resistance properties similar to high-grade cellulose nitrate lacquers, with the advantage of non-inflammability and stability to sunlight. Nitroparaffins are used together with ethyl and butyl alcohols as co-solvents, although under certain conditions it is suggested to be advisable to use butyl acetate instead of alcohols. Cellulose acetobutyrate solutions in ethyl acetate and methyl ethyl ketone have a high tolerance for butyl acetate with or without toluene. Diacetone with small quantities of nitroparaffins can be used in carefully-prepared formulations, although in this case the amount of diluents allowable is small. Cellulose triacetate can be dissolved in nitroparaffins plus a minimum of 10 per cent. chlorinated hydrocarbon, while it is also claimed that a monochloro mononitro alkane, together with an aliphatic monohydric alcohol, produces good solutions[24].

As far as can be ascertained, the usual plasticisers for cellulose acetate still serve, namely, triacetin, diacetin, dimethyl, diethyl, and methyl glycol phthalates, trichlorethyl phosphate, triphenyl phosphate. Various other products have been suggested in order to overcome the high rate of water absorption shown by the hydrocarbon-resisting plasticisers. Crotonates, formals, hydroxybutyric esters, trimethyl citrate, acetyl citrates, hexyl and octyl maleates, polyglycol ethers, glycerol ethers, esters of

nitroalcohols, butyl acetonyl phthalate, and methoxy ethyl acetonyl phthalate[29] are said to show promise. Liquid ammonia has been used as a solvent for cellulose derivatives for making films and filaments. A study of the solubility of plasticisers in ammonia has been reported[30].

Amylose triacetate is said to have possibilities in forming pliable, good tensile films; dibutyl phthalate (10-20 per cent.), tricresyl phosphate, diethylene glycol ether acetate, pentaerythritol acetate and sebacates are suitable plasticisers.

Starch adhesives, according to the literature[25], can be plasticised with glycerol, glycols, urea, sorbitol, castor oil, sodium acetate, sodium lactate, lactates, sodium nitrate, and alkali thiocyanates.

Zein appears to be of interest as a coating and waterproofing medium. This protein body is extracted from corn gluten by alcohol, to which ethylene glycol is added, so that after distillation of the alcohol the zein is left in a base solution ready for use. These solutions can be used for waterproofing paper, phthalates being used as plasticisers in the coating and sealing process. Zein acetate forms strong, flexible films with resistance to moisture, and is insoluble in alcohol unless solvents such as butyl lactate or Cellosolve are added[31].

Theory of Plasticisation

As mentioned earlier, the theory of plasticisation is under consideration, but so far, in most cases, behaviour can be explained by purely mechanical effects, as the plasticiser is added to the resin and a physical mixture made. On the other hand, with some polymers it is found better to add the "plasticiser" before polymerisation, with the result that the final resin has the required plastic qualities not inherent in the unmodified polymer. Ethyl maleate is an example of an ester used in this way, for instance with vinylidene chloride; while a small percentage of diallyl maleate co-polymerised with ethyl methacrylate gives a rubber-like plastic[32]. The use of polymerisable esters, such as the last mentioned, and diallyl phthalate, allyl acrylate, methacrylate or chloroacrylate has opened a fresh field where, by suitable adjustment of monomer and polymer, coatings of a permanent nature can be applied without the need for added solvents and plasticisers[33]. The mention of maleic anhydride brings a reminder that endomethylene tetrahydrophthalates are useful plasticisers (*e.g.*, for P.V.C.[34]). The acid radical is made by the junction of maleic anhydride with cyclopentadiene.

Looking ahead, it would seem that the use of solvents and plasticisers will continue to develop, even though military uses may slacken. The range is likely to be wider than before the war, with plasticisers made on a much larger scale. When the mass of data obtained during recent years is made public, and more products released, manufacturers in general may have information which will be of great use to guide their choice of correct materials.

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Chemical Engineers

Institution Annual Meeting Announced

IT is announced that the 23rd annual corporate meeting of the Institution of Chemical Engineers will be held at the Connaught Rooms, Great Queen Street, London, W.C.2, on April 13, at 11 a.m. Several vacancies among the officers and members of the Council will fall to be filled by selection, and the nominations of the Council for the vacancies are as follows: *President*: H. Griffiths; *Vice-Presidents*: C. J. T. Cronshaw, Sir Alfred Egerton, S. Robson, D. F. Sandys Wünsch; *Joint Hon. Secretaries*: M. B. Donald, L. O. Newton; *Hon. Treasurer*: H. W. Cremer; *Members of Council*: K. Fraser, R. F. Stewart, N. Swindin; *Associate Member*: S. B. Watkins.

Nominations from members in accordance with the Articles of the Institution must be received at the registered office of the Institution not later than March 2. Should there be no nominations from members, the nominees of Council will be declared elected at the meeting. The business meeting will open at 11 a.m.; the President will deliver his address at approximately 12 noon; luncheon will be served at 12.30 for 1 p.m.; at 3 p.m. Messrs. H. W. Cremer and R. L. Fitt will present a paper on the lay-out and construction of large works.

SAFETY FIRST

Personal Safety in Handling Chemicals—IV

by JOHN CREEVEY

IT is not only hands and eyes that need special protection against hazards. Over 20 per cent. of industrial accidents which ultimately result in workmen's compensation payments are found affecting the feet and legs, and to counter these there are special types of boots, over-shoes, non-slip soles and heels, shoes with hard toes, spats, leggings, and leg shields.

In some situations, for instance, it will be found advantageous to use shoes with wooden soles and leather uppers; where there is risk of the splashing of acids or hot liquids it is desirable to have boots or shoes that can be removed quickly when the need arises—boots which do not require to be unlaced. Some "quick removing" boots are provided with "zip" fasteners, but such fastenings can fail to function (even though inspected at regular intervals), and failure may occur at that precise moment there is need for quick removal. A boot with a "zip" fastener is also liable to "stick" when it has suffered a bad splashing of corrosive liquid, which may not only attack the metal of the fastener, but may equally well cause the deposition of a sticky mass which clogs the fastener and thereby hinders its action. It is far better to have boots provided with a series of leather loops which may be brought together and held secure by a kind of flexible skewer made of suitable material. This can be very quickly withdrawn, thereby releasing all the loops at once and permitting the boot to be removed without further delay.

Bootlace Holes

The mere provision of lace holes can make a boot hazardous to wear, even though there be an inner tongue of leather or rubber; it is by way of these lace holes that acid can more quickly reach the foot inside the boot. Canvas or leather leggings and spats, too, should not have lacing holes, nor wrinkles due to a bad fit, as these provide places where corrosive liquid may lodge and ultimately burn through to the leg. Moreover, leggings should be provided with flares which will adequately cover the tops of the boots or shoes, and as with boots in very hazardous situations, leggings should also be of a quickly removable pattern.

Shoes with heavily reinforced toes are as comfortable as shoes of the ordinary type, provided they are obtained from a reliable maker who should be experienced to fit them properly; where a man has constant need of using such shoes, it is advisable for him to have the shoes specially fitted, even though this involves travelling expenses and the loss of a day's working time.

As regards rubber boots, remember that the quality of rubber varies, and only dealings with a reputable maker can assure safe use under hazardous conditions with reasonably long life included. All rubber boots need care in use, with regular washing to remove any accumulation of corrosive material at the end of each working shift.

Wearers of rubber boots will find that the use of heavy woollen socks worn over an inner light-weight cotton sock brings added comfort; this practice also prevents ill-effects on the circulation of the blood, to which some wearers of rubber boots are especially subject. Each worker should have his own pair of rubber boots, and be responsible for seeing that the interior is kept clean; where boots are shared between several men, there is need to sterilise them regularly.

In situations where workers are likely to get heavy splashes of corrosive liquid on the feet and legs, it is an advantage to have wide-top tubs of water placed in convenient and accessible positions, into which a man can step immediately an accident occurs; the provision of such tubs is sometimes almost as essential as the providing of a quick-release water shower. In more than a few instances the provision of such a tub of water has allowed a man to escape injury from a serious accident, apart from a few minor burns; these accidents have mostly been associated with stills of the direct fire-heat type, and have occurred following the opening of the furnace door or the ash-pit door, when the resulting inrush of cold air has caused a sudden failure at a weak spot in the body of the still.

Head Protection

There is also need for hats and helmets reinforced to resist the blow from a falling object or sudden impact of the head against pipes where conditions of lay-out are awkward. If a man has constantly to pass beneath pipework which is lower than 6 ft. from the floor, he should be provided with head protection—it is not only miners who need this. Plant situations are also known where it would be advantageous to use a helmet with lamp attached, not only for

general handiness, but also because the lack of light—natural and artificial—makes this essential to safety in passing an assemblage of pipework and fittings.

A broad-brimmed hat made of felt or rubberised material is useful for protecting the head and neck against corrosive drips; still greater protection is afforded by a similar hat with a light-weight curtain of acid-proof material covering the shoulders. Properly designed, such forms of head protection are not uncomfortable; the present form of "hard" hat used in industry to give protection against falling objects is really an extremely serviceable light-weight affair which might well be used in many chemical works.

When accidents affect the legs, arms or head, it is sometimes found that they are peculiar to the works where they occur, and in such circumstances a careful inspection of the works must be carried out to remedy the possible causes, and safety equipment designed to give the protection needed. Hand, wrist, and arm protection against splashing liquids which have to be stirred occasionally, or merely sampled, consists of a rubber gauntlet and close-fitting arm-piece or sleeve which gives additional protection from the wrist to the shoulder, where it is secured by a light strap fastening on the opposite shoulder.

Men working at acid tanks generally need extensive protection; rubber aprons should reach well below the knees; boots should give protection as far as the hip. Moreover, the tops of the boots must not be left open so that a bad splash of acid—higher than usual—may run down the inside; there should be an efficient means for drawing the tops close to the other clothing which is worn. For special situations there are complete rubberised suits in form of overalls, with draw-strings at the neck, at the cuffs, and at the ankles. In addition, goggles, or perhaps a complete hood to cover the head, may be necessary. Further, let it be remembered that where rubber coverings are provided to give protection against chemicals, it does not follow that this rubber will prove effective against the hazard of electric shock, for which rubber of insulation quality is demanded.

Industrial Safety Gleanings

Lifting Tackle in Acid Atmospheres

SOME useful safety pointers are contained in the latest issue of the *Industrial Bulletin* of the Royal Society for the Prevention of Accidents (1944, *12*, No. 125). One of these calls renewed attention to a factor which has been dealt with in the past, and is an especially useful reminder where workers new to metallurgical industry are concerned: the use of lifting tackle in connection with pickling baths.

The worst possible conditions for lifting tackle are created by alternate dipping in hot acid and exposure to atmosphere: the worst corrosion is said to appear at the air-line. Chains exposed only to acid vapours and steam do not fare quite so badly. The methods of dealing with the problem are:

(i) The use of corrosion-resisting alloys.
(ii) Employing over-size mild steel or wrought iron chains.
(iii) Avoiding the immersion of chains in baths by using cradles.
(iv) Protective coatings.

The special metals chiefly, and very strongly, recommended are Monel metal for hydrochloric, sulphuric, and hydrofluoric acids, and stainless steel for nitric acid and mixed acids. Monel metal, however, should not be used in the galvanising bath. It forms an amalgam with spelter and will, if dipped in it, become rigid. Regular inspection, whatever the metal used, is an urgent necessity.

When wrought iron and mild steel chains are used in pickling processes, there is not only the simple eating away of the surface metal to contend with, there is also a tendency to localised pitting at areas of pressure between links. Further, experiments have established that the sudden and unexpected mechanical failures that sometimes occur with such gear, when used in acid baths, are partly due to changes in the metal, *i.e.*, to acid attack around the grain boundaries and to hydrogen embrittlement. Both these increase with stress. Once a chain has been highly stressed, the rate of acid attack becomes high and remains so—even increasing with time—until the next annealing. Inhibitors, it should be noted, have only a small effect on failures due to high-stress crystal corrosion or pit corrosion.

With wrought iron or mild steel, the load should be limited to 2/5ths of the SWL: annealing or stress-relieving should be carried out once in every two months; and the use of the same chains in both acid and alkali baths should be prohibited.

Protective Coatings

Protective coatings are of two main types. (i) Rubber or ebonite. This is usually on rod; but sudden failures of coated rod have occurred, presumably due to minute undetected hair-cracks, through which acid has gained an entry. Lead-coated rod has also been mentioned as a possibility but no actual use of it has been traced. (ii) Patent

acid-resisting applications. These do not appear to stand up well to use in baths though they can give protection in acid atmospheres.

Causes of Dermatitis

A recently revised edition of Health Practices Pamphlet No. 10, Skin Affections, published by the National Safety Council of the U.S.A., classifies the causative factors of dermatitis according to how they act on the skin. The following ten groups are mentioned:

(a) Detergents and keratin solvents. These are substances which remove the natural oil from the skin (alkali, turpentine, or such alkalis and soaps), and set up a reaction with the oils of the skin to increase susceptibility to chemicals (cottonseed and olive oils, alcohol, phenylene bases, and several aromatic hydrocarbons).

(b) Desiccators and hygroscopic agents. These substances take the water out of the skin and generate heat. Examples are sulphur dioxide and trioxide, nitrous anhydride, phosphorus pentoxide, nitric anhydride, strong acids and alkalis.

(c) Protein precipitants, tending to coagulate the outer layers of the skin, *e.g.*, heavy metallic salts and those which form alkaline albuminates in combining with the skin, as mercuric and ferric chloride; and alcohol, tannic acid, formaldehyde, picric acid, phenol, and ultra-violet rays of too great an intensity.

(d) Hydrolytic or electrolytic substances which unite with water of the skin and thus form irritating compounds or dissociate into irritating elements when in contact with water or electricity. Examples are mustard gas, nitrate of ammonia, hexamethylene tetramine.

(e) Oxidisers, such as nitrates, chlorine gas, iodine, bromine, hypochlorites, ferric chloride, hydrogen peroxide, chromic acid, permanganates, ammonia, ozone and others.

(f) Toxic nitro-derivatives, which are solvents of essential skin constituents; for example, materials of this type are T.N.T., D.N.T., tetryl, picric acid, phenols, cresols.

(g) Keratogenic and neoplastic agents, which stimulate abnormal growth and may cause either malignant or benign tumours. These materials are typified by arsenic, coal-tar products, petroleum and shale, and aniline and other dyestuff intermediates.

(h) Biotic agents, vegetable and animal.

(i) Allergic or anaphylactic proteins, which produce antibodies in certain sensitive persons.

(j) Reducers. These break up water on the skin and thereby free hydrogen, which thickens the outer skin layer and, in strong solutions, causes shedding of the horny layers. Materials of this group are photographic developers, tar, phenols and naphthols, aromatic and aliphatic hydrocarbons, salts of titanium, resorcinol, formaline, paraldehyde, and salicylic, formic, and oxalic acids.

Polymer Fire

Last summer a flash occurred at the Light Ends Recovery Plant of the Polymer Corp., Sarnia, Ont., and a fire resulted. A 1½-in. nipple, connected to the outlet line from an overhead condenser of the de-ethyleniser tower, ruptured on the upstream side of the shut-off cock. The pressure on the condenser is 500 lb./sq. in. and the break allowed the liquefied hydrocarbon condensate to escape to atmosphere, where the liquid immediately volatilised, forming a gas cloud. As the wind-borne cloud reached a point about 150 ft. from the break, it became ignited from a source as yet undetermined, and the flame travelled back to the broken nipple.

The procedure followed in handling the fire was first to depressure the unit as rapidly as possible, and at the same time endeavour to control the flames and absorb the heat by blanketing the area with water spray through monitors, hoses and fog nozzles. The operator was initially handicapped by the fact that several assistants were injured in the fire, but help soon arrived from other units. The flames were carried up around the adjacent towers and caused the safety valves to let go and torch. With loss of pressure on the de-ethyleniser, the intense fire dropped to a localised torch, which was kept under control by water spray. When the other sections of the unit had been depressured, the condenser was isolated by closing the block valves by means of an extension handle and the fire extinguished.

Coal Gas and China Clay

What is happily an extremely rare type of accident caused the death, on January 2, of Mr. W. H. Gared, a china-clay worker employed by English Clays Lovering Pochin & Co., Ltd., at St. Austell, Cornwall. Mr. Gared, who was 50 years of age and a normally healthy man, and had been directed to the china-clay works last October, was overcome by coal-gas fumes, and collapsed in the meal-room at the works. Other workers had complained of coughing and vomiting. In the lay-out of the works there were two "dries" adjoining, with one stack in the centre. Fires were lit in one "dry" on January 1, and, in the opinion of the works manager—as the weather was very still and it was difficult to get a draught—some smoke, with fumes, might have come through the flues under the other "dry" and out at the meal-room end. It would appear that the installation of some type of artificial ventilation, for use in exceptional weather conditions, is an essential safety adjunct at this type of plant.

Swiss Chemical Industry

Strong Position Maintained

IN THE CHEMICAL AGE of December 30, an advance summary was published of an interesting American report on the Swiss Chemical Industry. Meanwhile, the full version has arrived in this country and is being reproduced for the benefit of our readers who, no doubt, will recall that one of the major developments mentioned in this article were first given publicity in this country in this journal.

The changes which have marked developments in the Swiss chemical industry in recent years continued throughout 1943, according to the annual reports of leading Basle chemical companies—including the Society of Chemical Industry (Ciba); Sandoz, A.G.; Durand and Huguenin, S.A.; and F. Hoffmann-La Roche & Co., A.G. These changes have been largely at the expense of dyes, which have been essential for the continued existence and prosperity of the domestic industry for half a century, and in favour of other products, notably in the pharmaceutical field, also an old and important Swiss industry, and in synthetic resins and tanning materials.

According to a report by Mr. Walter H. Sholes, U.S. Consul General, Basle, published in *Foreign Commerce Weekly*, many items which were formerly imported and new intermediates were taken up in ever-increasing measure by the Basle chemical manufacturers. The reverses sustained in the dyes branch have been counterbalanced by the improved turnover in the pharmaceutical departments. In addition, progress seems to have been made in synthetic adhesives, and in solvents and various materials used in the manufacture and processing of varnishes, lacquers, and rubber. There have been far-reaching developments in the manufacture of products for plant protection, and insecticides. The large dye manufacturers expect to get back into full-scale dye production after the war and to regain markets.

Currency Problem

Swiss chemical firms reported that they had to face seemingly unsurmountable difficulties connected with the transfer of earnings of their foreign manufacturing plants. The fact that they were successful to a certain extent enabled them to liquidate large amounts in foreign currencies, greatly relieving their financial positions.

Business in Europe was severely handicapped as regards foreign transactions. The Swiss, however, maintained relations with European markets, deliveries from Swiss factories abroad and stocks warehoused there permitting. Exports to overseas countries were increased. One firm's report revealed that the exchange of goods with those countries with which free money transactions were still possible was less than 15 per cent. of its total imports and exports in 1943.

Success also attended the development of the Swiss domestic market which, under present conditions, will continue to attract manufacturers until the return of more nearly normal conditions in Europe.

Production Difficulties

Swiss manufacturers point out that the blockade and counterblockade, together with the currency policies of the various belligerents, were felt to an increasing extent. Difficulties incident to obtaining machinery and raw materials, as well as in the sale of products, became more severe. Imports from abroad decreased further, especially imports from overseas for the chemico-technical branch, but the domestic supply situation was relieved somewhat by further increasing the manufacture of certain controlled intermediate products in Switzerland. With the increasing scarcity of goods in Europe, imports from Axis countries could not compensate for the absence of imports from overseas. Nevertheless, it was possible for many of the Basle manufacturers to overcome limitations imposed by the war.

During 1943, one firm reported that it was able to provide, with few exceptions, its manufacturing plants with plently of raw materials, intermediate products, and fuel, although prices for such increased greatly. Apart from closing on Saturdays, it was possible to avoid other restrictions in the working schedule. The firm was able to maintain the same number of employees.

Another firm revealed that, for the first time, it was unable to sell all its products completely, despite increasing demands from all sides.

Still another firm reported that, owing to the fuel shortage, it was compelled to discontinue its manufacture of dyes and certain intermediate products at some periods in 1943. During these periods the workers were sent to assist in the cultivation of fields, at wages on practically the same level as in the factory, the funds being contributed by the Wage Compensation Fund and by the firm.

The problem of mounting costs has been one of increasing difficulty. Transport charges, and especially insurance rates on raw materials and finished products, were heavier. The Swiss wage scale is relatively high, corresponding to the high standard of living. The shortage of certain

raw materials forced the chemical firms to use more expensive substitutes or to manufacture such products in their own plants. In this latter case the research thus required caused additional expense.

Research and Rationalisation

In view of the increase in production costs, Durand & Huguenin reported that they had adopted the policy of directing efforts toward regaining markets by bettering the quality of their special products. The research department is reported as being continuously occupied in extending the variety of products, the chief object being to produce new, original dyes of greater degrees of purity. Efforts also were directed toward improvements in production methods. However, because of general war conditions, it is not yet possible to exploit the results of such research.

F. Hoffmann-La Roche & Co. reported that it had decided to continue increasing its production facilities and to intensify research, especially in the direction of vitamin-C production. It hoped thereby to contribute a not unimportant share in the recovery of Europe after the war.

Ciba has again expended considerable sums for the development and rationalisation of its plants, to meet both changing market conditions and the need for research. Despite difficulties, this firm is apparently keeping its assortment of high-class dyes in line with scientific research and is endeavouring to hold its own in the sphere of synthetic organic dyes. It hopes that, after the war, it will be in a position to cover even the most exacting demands. Being in competition with foreign concerns and having only a small home market, the Swiss chemical industry has always been forced to create and offer to the public at lower cost, if possible, more commodities of better quality.

Domestic Supply and Demand

It is pointed out by the trade that Swiss exports amounted to 75 or 80 per cent. of the total production in 1943. Before the war, the proportion was, in round figures, 95 per cent. exports and 5 per cent. domestic consumption. From this, the trade says, it can be seen how Switzerland's position could be strengthened and how advantageous it was to find at home compensation, in part at least, for lost export possibilities. Nevertheless, it must be remembered that domestic business declined in 1943, owing principally to lack of raw materials in the industries using dyes—namely, the wool, cotton, and leather industries.

The Swiss Tar Industry, A.G., at Pratteln, near Basle, as the central distillation plant for tar accruing from the Swiss gas works, provides the Swiss chemical industry with indispensable tar products. Another company, Lonza, manufactures aniline oil derived from nitrate products, and also important raw and intermediary products from carbides. The Swiss Powder Factory in Dottikon produces benzene in its gas plant and manufactures basic materials in its large distillation and nitrate plant.

The production of other basic materials, such as caustic soda, sulphuric acid, hydrochloric acid, nitric acid, and chlorine, was begun in Switzerland during the last war. Existing manufactures almost completely cover Swiss requirements; in cases where manufacture was inadequate, appropriate measures were taken to guard against shortages. There is no scarcity of these products at present. Nevertheless, production of tar, benzene, soda products, and carbide is dependent upon the supply of coal from abroad; and that of sulphuric acid, on the supply of imported pyrites or sulphur. As regards coal supplies, Switzerland depends almost entirely on coal and anthracite from the mining areas of Western Germany, such as the Aachen, Ruhr and Saar districts, which now have become theatres of war. There is, naturally enough, anxiety in Switzerland as regards future supplies as domestic mines in Canton Valais yield only small quantities of low-grade coal.

The improvement in the synthetic tanning materials industry in 1943 reflected an increase in export sales rather than in the domestic demand. Shortage of raw hides, attributed to reduced slaughtering and smaller imports, lowered operations in Swiss tanneries considerably. Synthetic tanning materials have given evidence of their superior qualities, and business in these new materials is expected to be important after the war.

Synthetic Resins

Business in synthetic resins was reported as satisfactory during 1943 despite increased difficulties in procuring raw materials. The completion of plants made it somewhat easier to supply customers. The articles produced from synthetic resins in Switzerland are sold under the names of "Cibanoid," "Cibanit," and "Melopas" and are reported as gaining in popularity, especially in the electrical-engineering trade, in radio-apparatus construction, as well as in connection with household and other articles.

The business in "Melocol" adhesives, for which synthetic resin is used as a basis, is also reported as having been gratifying during 1943. There are signs that they will be used more and more in the woodworking industry, especially for bridge construction and for purposes of wood conservation. Synthetic adhesives will become important as a binding substance in various industries, especially in the cork industry and as a core-binding material in iron foundries.

A number of synthetic-resin preparations

have been introduced also in the textile-finishing industry for cloth finishing, cementing, delustring, and improving quality. In the lacquer industry, a further development is expected in the use of synthetic resins. Sales of synthetic resins for impregnating and stiffening purposes in the Swiss shoe industry were not important in 1943.

Dyestuff Industry

Dye exports decreased, in comparison with 1938, by approximately one-third in quantity and approximately two-thirds by value; and, when compared with 1939, the decreases were 30 and 50 per cent. One of the chief reasons for the decline is that natural textile fibres were lacking in many European countries and could be only partially replaced by substitute fibres, such as rayon and cellulose wool. Competition was keen for the remaining markets.

Ciba concentrated its efforts on the technical and scientific aspects of production of its most important kinds of dyes, supplementing at the same time its assortment of textile auxiliary agents by some new preparations. J. R. Geigy, A.G., reported that its dye business declined in 1943, compared with 1942, and that its share in the total turnover was proportionately less. European and domestic business as well as sales to North America were reduced, whereas exports to South America and Central America showed a rising tendency.

Sandoz stated that its export trade was maintained on a considerable scale. With Genoa no longer available as a port for shipments overseas, a substitute route was opened *via* Marseilles.

Insecticides

The most recent branch of the Swiss organic chemical industry—the manufacture of products for plant protection and of insecticides—made great progress. Cultivation in Switzerland and in foreign countries was favourably influenced by the dissemination of these insecticides, which promise to become an important Swiss export commodity.

These trade-marked products are: "Gesarol" (made by Geigy), a term applied to a series of insecticidal compositions for use against agricultural pests; "Neocid," a term applied to a series of insecticidal compositions for use against insects affecting man and animal; and "Neocidol," for animals.

"Trix," a product recently placed at the disposal of the Swiss public, supplements "Mitin" and is applied to fibres, in the process of manufacture or finishing, to obtain permanent protection against moths. Geigy's development of DDT abroad has already been fully treated in our columns.

Personal Notes

MR. G. H. WHIGHAM has been appointed chairman of British Celanese, Ltd., in succession to the late Dr. Henry Dreyfus.

MR. S. C. LESLIE, formerly publicity manager to the Gas Light and Coke Company, but released by the company for Government service in 1940, was last week appointed chairman of the Council of Industrial Design at its inaugural meeting on January 12.

SIR MURDOCH MACDONALD, K.C.M.G., C.B., M.P., was re-elected president of the Institution of Factory Managers at the general meeting on January 20. MR. ALEXANDER PEET succeeds Mr. J. Lyon Turner as chairman, and MR. W. S. ANDERSON succeeds Mr. Peet as vice-chairman.

DR. LAWRENCE W. BASS has been elected president of the American Institute of Chemical Engineers. He is associate director of chemical research of Air Reduction Co., and of U.S. Industrial Chemicals, Inc. DR. ALBERT B. NEWMAN, dean of engineering and professor of chemical engineering, Chemical College, N.Y., has been elected vice-president.

MR. DONALD M. NELSON, the former chairman of the War Production Board, Washington, has arrived in Chungking to organise a similar organisation for China. As soon as war production is well under way, Mr. Nelson will return to the U.S.A., but his assistant, Mr. H. Coonley, and six experts in alcohol and steel production will remain in China.

MR. R. ANTROBUS LYNEX has been appointed secretary of I.C.I., Ltd., after having been an under-secretary since the formation of the company, to which he was transferred from Brunner Mond & Co., of Northwich. He was educated at Eastbourne College and was admitted a solicitor in 1923. He obtained first-class honours and was awarded the Birmingham Law Society's gold medal and the Horton Prize.

MR. A. E. SYLVESTER, managing director of the Gas Light and Coke Company, has been elected chairman of the new committee formed by merging the Central Executive Board of the National Gas Council and the Executive Committee of the British Commercial Gas Association. This committee will act as a joint governing body for the gas industry throughout the country, pending the formation of the British Gas Association and the appointment of a director, which is regarded as a matter of urgency. The new committee will devote its energies at once to the question of co-ordination in the gas industry by bringing into line, and, where necessary, eliminating, the numerous

sub-committees and other subsidiary bodies now in existence.

SIR CLIVE BAILLIEU, K.B.E., C.M.G., at the Grand Council meeting of the Federation of British Industries on January 10, was nominated for election at the annual general meeting in April as president of the Federation for the ensuing year. The nomination, which was unanimously approved, was moved by Sir George Nelson, who will retire from the presidency in April, having held office for two years. In 1941-43 Sir Clive Baillieu was Director-General of the British Purchasing Commission in the U.S.A. He is a director of the British Metal Corporation, Ltd., the Imperial Smelting Corporation, Ltd., and the Dunlop Rubber Co., Ltd., and, before going to the United States on the Government's behalf, was an executive member of the Export Council.

DR. LESLIE FREDERICK WIGGINS, of Birmingham University, has been awarded the Harrison Memorial Prize for 1944, in recognition of the outstanding quality of his researches on transformation products of the hexose sugars. His originality and resource, combined with exceptional experimental skill, have opened new fields of theoretical interest; and much of this work holds promise of practical development along novel lines. The Harrison Prize is awarded to the chemist of either sex being a natural born British subject, not at the time over 30 years of age who, in the opinion of the Selection Committee (the presidents of the Chemical Society, the Royal Institute of Chemistry, the Society of Chemical Industry, and the Pharmaceutical Society), shall, during the previous five years, have conducted the most meritorious and promising original investigations in chemistry and published the results of those investigations in a scientific periodical or periodicals. The prize is to be regarded as an exceptional distinction to commemorate an exceptional man.

Obituary

MR. FIN SPARRE, director of E. I. du Pont de Nemours, and for 25 years director of its development department, until August 31, last, died of a heart attack on October 7 at his home in Wilmington.

General News—From Week to Week

The Minister of Supply announces that the selling price of tungsten ore has been reduced to 90s. per unit of WO_3 delivered consumer's works.

Factory Form No. 278, dealing with fencing and other safety precautions for power presses, has been issued by the Ministry of Labour, price 1d.

A new specification for silica gel, No. D.T.D. 471A (H.M.S.O., 6d.), issued by the Ministry of Aircraft Production, supersedes No. D.T.D. 471.

The Ministry of Supply has decided that the selling price of rennet casein will be reduced from £130 to £115 per ton as from February 1.

Chemists interested in rheology will find a useful glossary of rheological terms and an interesting classified bibliography in the current issue of *Paint Technology* (1944, *9*, pp. 244-7).

A correction: the preferred structural formula for allicin given in our last week's issue (p. 68) lost an oxygen atom. It should have read: allyl—S—S—allyl

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An exhibition, entitled "Wealth from Salvage," organised by the Ministry of Supply, is on view at the Carlton Hotel, Haymarket, London, S.W.1, from January 19 to February 3. It is open to industry only by invitation.

Traders may now obtain, from Ministry of Supply stocks, certain grades of beeswax for re-export to approved destinations. Prices, etc., may be obtained on application to the Ministry of Supply, Sundry Materials Branch, 8-10 Old Jewry, London, E.C.2.

The National Smoke Abatement Society has sent to municipal authorities a memorandum on the importance of the reduction of the amount of smoke emitted and points out that the matter is of urgency in view of future extensive new housing developments.

An interesting selection of photographs, lent by the Miners' Welfare Commission and illustrating some of its work, is being exhibited in the Ministry of Town and Country Planning at 32 St. James's Square, S.W.1. It can be visited without formality by members of the public until the end of January.

Discussing the chemistry of gems before the Royal Society of Edinburgh last week, Professor W. T. Gordon, of the Department of Geology, King's College, London, referred to the achievement of the chemist in producing corundum in every natural colour, notably by means of the Verneuil inverted blowpipe. Another triumph of the chemist was the manufacture of rock crystal; so far, crystals up to half an inch long had been made, but there was a field open to the chemical worker in the production of larger crystals to meet the demands of industry.

At the end of 1944 workers and residents in the County of London had made a total contribution of no less than £1,558,598 to the Red Cross Penny-a-Week Fund. Birmingham's total of £375,104 was the next largest.

In the course of a discussion following the recent interesting papers by Dr. Barnes and Mr. Tritton on the choice of materials for scientific photography, before the Association for Scientific Photography, Mr. McV. Weston made a plea that photographic manufacturers should publish more detailed curves showing the properties of the materials they manufacture.

The Umney Memorial Prize has been founded by the Pharmaceutical Society of Great Britain, in memory of its distinguished members Charles Umney and his son John C. Umney. It is open to candidates for either of the qualifying examinations whose work in practical pharmaceutics is of the highest merit. The prize consists of pharmaceutical books or apparatus to the value of £25.

A memorial service for Dr. Henry Dreyfus, Chairman of British Celanese, Limited, was held on January 9, at the Liberal Jewish Synagogue, London, N.W.8. The congregation included relatives, business friends and members of the London office staff of British Celanese; and among those present were personalities well known in the chemical industry, including Lady McGowan (also representing Lord McGowan) and Professor I. M. Heilbron. The Society of Dyers and Colourists was represented by Mr. F. Smith (vice-president) and Mr. H. Foster (secretary, W. Riding Section).

The third in the current series of lectures arranged under the auspices of the Industrial Pest Control Association was held on January 9, at the Shell Mex Laboratories, Fulham. The lecture was entitled "The Biological Testing of Insecticides" and was followed by a demonstration of practical methods of testing insecticides and methods of rearing mosquitoes and houseflies. The lecturer was Mr. L. W. Leyland Cole, Technical Products, Ltd. Earlier lectures in the series were "The Mode of Action of Insecticides," by Professor J. W. Munro, and "Some Aspects of the use of DDT in Industrial Pest Control," by Dr. T. F. West and Mr. G. A. Campbell.

Foreign News

"Du Pont Research" was the subject of an address given by Dr. Bolton, Du Pont's chemical director and recipient of this year's Perkin Medal, delivered before the American Section of the Society of Chemical Industry. He stated that in 1942 half the gross sales of the company came from products that either did not exist in 1928, or were not made commercially.

Engineers' Specialties Division, of the Universal Engraving and Colorplate Company, Inc., New York, has just published a booklet which describes two new types of Detail Engineers' Glass, as well as new Grid Comparator Charts.

The Spanish Cabinet has approved increases in railway rates to take effect immediately. Passenger fares are increased by 25 per cent., staple goods freights by 20 per cent., and other goods traffic rates by 30 per cent. Coal, cement and fertilisers are not subject to these increases.

Endeavours to establish a new international tin agreement on different lines from the old tin restriction scheme are not being welcomed by British representatives in the United States. However, they seem to be keener on new international copper and zinc agreements, writes the *Metal Bulletin*.

Plans for the construction of a large-scale fertiliser plant in Travancore—first reported in THE CHEMICAL AGE on November 25—are in the hands of the Intercontinent Corporation of New York. The W.P.B. has been asked by representatives of Travancore State to release building materials under an agreement to pay cash instead of through Lend-Lease. It is reported that the British dollar pool control has agreed to release $2,704,000 (£676,000) for this purpose.

The restoration by early September last of factories for the production of building materials in Stalino Oblast, Soviet Union, included 5 alabaster plants with an annual capacity of 181,000 tons, 7 lime factories with 105,000 tons capacity, and 22 brick and tile factories, states a Soviet press report. Two factories for the production of high-grade gypsum, each of which is capable of producing 20,000 tons, are scheduled to go into operation soon.

The first school of chemical engineering in Brazil is to be established in the city of S. Paulo. The new institution will combine with the School of Business Administration and the School of Technical Drawing to form the Technical University of S. Paulo. Industrialists, both in Brazil and in the United States, will give financial support and equipment. Plans involving some $2,000,000 for construction were drawn up in the United States, which will also send at least three instructors.

Forthcoming Events

January 20. Institution of Factory Managers, Oak Room, Kingsway Hall, W.C.2. 2.30 p.m. Extraordinary general meeting.

January 20. Institution of Chemical Engineers (North-Western Branch). Reynolds Hall, The College of Technology, Manchester. 3 p.m. Mr. J. P. Asquith: "The Unit Process of Mixing."

January 22. Electrodepositors' Technical Society, Northampton Polytechnic Institute.

St. John Street, Clerkenwell, E.C.1, 5.30 p.m. Dr. S. G. Clarke and Mr. J. F. Andrews: "The Chromate Passivation of Zinc."

January 24. Institute of Fuel (North-Western Section). Engineers' Club, Manchester, 2.30 p.m. Dr. J. G. King: Resumé, Melchett Lecture: "Pattern of Fuel Research."

January 24. British Association of Chemists. Chamber of Commerce, New Street, Birmingham, 6.30 p.m. Joint meeting of Midland chemists to discuss "Social Security for Chemists." Professor R. G. W. Norrish in the chair.

January 24. A.B.C.M., Fuel Efficiency—Technical Discussions. Meeting Room No. 1, Gas Industry House, 1 Grosvenor Place, S.W.1, 2.30 p.m. Mr. A. L. Hancock (Electrofio Meters Co., Ltd.): "Boilerhouse Instruments and Automatic Controls."

January 24. British Rheologists' Club, The Faraday Society and the **Plastics Group.** Lecture Theatre, Institution of Mechanical Engineers, Storey's Gate, S.W.1, 2.30 p.m. Dr. G. W. Scott-Blair: "The Rheology of Plastics."

January 25. Mineralogical Society. Apartments of the Geological Society of London, Burlington House, Piccadilly, W.1, 3.30 p.m. Lt.-Col. J. V. Ramsden: "Practical Barytes Mining in Devonshire."

January 27. The Textile Institute (Lancashire Section). St. Mary's Parsonage, Manchester, 2.45 p.m. Dr. T. Vickerstaff (I.C.I. Dyestuffs): "Colour and Light."

January 27. The Association of Scientific Photography. Caxton Hall, S.W.1, 2.30 p.m. Mr. H. K. Bourne: "Electric Discharge Lamps for Photography" (with demonstration of a range of apparatus).

January 29. Institution of the Rubber Industry. Court Room, Caxton Hall, S.W.1, 6.30 p.m. Dr. S. Buchan: "New Methods of Moulding."

January 31. Royal Institute of Chemistry (Birmingham and Midlands). Technical College, Wolverhampton, 6 p.m. Dr. J. H. Schulman: "Synthetic and Natural Emulsions."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an * —followed by the date of the Summary, but such total may have been reduced.)

ASSOCIATED PORTLAND CEMENT MANUFACTURERS, LTD., London, S.W. (M., 20/1/45.) December 27, Trust Deed dated December 21, 1944, securing £1,500,000 3½ per cent. second debenture stock with a premium of 2 per cent., present issue £1,057,108; general charge (except uncalled capital). *£2,983,897. June 13, 1944.

NATIONAL FIRE PROTECTION CO., LTD., Richmond (Surrey). (M., 20/1/45.) December 14, assignment, securing to Barclays Bank, Ltd., all moneys due or to become due to the Bank; charged on contract moneys. *£38,685. October 13, 1943.

RUBBER & TECHNICAL PRESS, LTD., London, S.W. (M., 20/1/45.) December 20, £100 debenture, part of a series already registered. *£325. September 1, 1944.

SOFNOL, LTD., London, S.E., manufacturers of water softening materials. (M., 20/1/45.) December 27, £1000 mortgage, to Credit for Industry, Ltd.; charged on property at Anchor and Hope-lane, Charlton, and further pieces of land at Anchor and Hope-lane. *£4725. September 20, 1944.

Satisfaction

PETROFUEL PRODUCTS (PORTH), LTD. (M.S., 13/1/45.) Satisfaction December 18, of debentures registered February 20, 1942, to the extent of £166 13s. 4d.

Declarations of Solvency Filed

EASTERN CHEMICAL CO., LTD., London, E.C. (D.S.F., 20/1/45.) December 16.

IMPROVED EMULSIFICATION PROCESS CO., LTD., Loughborough. (D.S.F., 20/1/45.) December 27.

Companies Winding-up Voluntarily

EARLSFIELD MANUFACTURING CO., LTD. (C.W.U.V., 20/1/45.) December 30. With a view to the transfer of the whole of the undertaking to Imperial Chemical Industries, Ltd. (Leathercloth Division). H. W. Edwards, 55 Garratt Lane, London, S.W.18, appointed liquidator.

I.C.I. (ALKALI), LTD. (C.W.U.V., 20/1/45.) December 30. With a view to the transfer of the whole of the undertaking to Imperial Chemical Industries, Ltd. J. K. Batty and D. Drummond, Winnington, Northwich, Cheshire, appointed liquidators.

I.C.I. (PLASTICS), LTD. (C.W.U.V., 20/1/45.) December 30. With a view to the transfer of the whole of the undertaking to Imperial Chemical Industries, Ltd. C. S. Guthrie, Black Fan Road, Welwyn Garden City, Herts., appointed liquidator.

IMPROVED EMULSIFICATION PROCESS CO., LTD., Loughborough. (C.W.U.V.,

20/1/45.) December 29. P. C. Sharp appointed liquidator.

MINERS' SAFETY EXPLOSIVE CO., LTD. (C.W.U.V., 20/1/45.) January 1 (members), in consequence of the assignment and transfer of the whole of the undertaking, assets and liabilities of the company to Cooke's Explosives, Ltd. W. Levett, of Miners' Safety Explosive Co., Ltd., Penrhyndeudraeth, appointed liquidator.

TAMPICO OIL, LTD. (C.W.U.V., 20/1/45.) January 3. C. M. Duncan, 112 Cannon Street, E.C., liquidator.

Company News

" Shell " Transport and Trading Co., Ltd., is again paying an interim dividend of 2½ per cent., tax free.

The Universal Asbestos Manufacturing Co., Ltd., announces a profit for the year to October 1 of £110,652 (£112,401). The dividend remains unchanged at 20 per cent.

Turner and Newall, Ltd., report a net profit, for the year to September 30, of £545,665 (£553,292). The final ordinary was maintained at 8¾ per cent., making again 12½ per cent.

Pacific Salt Co., Ltd., proposes a voluntary liquidation to be submitted at an extraordinary general meeting to be held at 112-114 Cannon Street, E.C.4, on January 25, at noon.

British Industrial Plastics, Ltd., record a gross profit, for the year to September 30, of £240,107 (£327,852) while the net profit is shown at £21,705 (£21,658). The dividend is maintained at 8 per cent.

Papermakers' Chemicals, Ltd. (formerly Pochins anti Paper Makers' Chemicals, Ltd.), St. Austell, Cornwall, have changed their name to Hercules Powder Company, Ltd.

The Midland Bank, Ltd., announces a net profit for 1944 of £2,038,274 (£1,984,397), and a final dividend of 8 per cent., making 16 per cent., less tax (same). Forward, £708,414 (£682,830).

Dussek Brothers and Co., Ltd., announce a net profit for the year ended October 31, of £20,635 (£21,174). A final dividend of 8½ per cent., making 12½ per cent. (same), was declared.

English Clays Lovering Pochin and Co., Ltd., report a net profit, to September 30, of £94,227 (£79,494). An ordinary dividend of 2½ per cent. (2 per cent.) was declared.

Hercules Powder Company, Ltd., St. Austell, Cornwall, have increased their nominal capital, beyond the registered capital of £12,000, by the addition of £8000 in £1 ordinary shares. To February 28, 1944, 12,000 shares had been issued, of which Hercules Powder Co., Inc., of Wilmington, Del., U.S.A., held 11,995 shares.

Chemical and Allied Stocks and Shares

STOCK markets have not been very active, although the general tone has continued good, with British Funds again moving higher and investment demand extending to leading industrial shares, confidence being indicated by the absence of selling. Imperial Chemical further strengthened to 40s., Turner & Newall rose to 85s. 6d., British Oxygen to 88s. 6d., and United Molasses to 39s. 1½d. The units of the Distillers Co. have been active up to 115s., easing later to 113s. 9d. Far Eastern shares were marked up on the war news. Apart from rubbers, teas, and tins, Royal Dutch Oil improved to 35¼, " Shell " to 84s. 4½d., Burmah Oil to 86s. 3d., and Anglo-Iranian 110s. 7½d. Dunlop Rubber were firm at 48s. 9d. on the company's Far East interests, as were Lever N.V. at 47s. 6d.

B. Laporte moved higher at 86s. 3d., and W. J. Bush were 70s. xd. with Monsanto Chemicals 5½ per cent. preference again 23s., British Drug Houses 29s. 6d., and Greeff Chemicals Holdings 5s. ordinary improved to 8s. 9d. Burt Boulton were 24s., British Aluminium 45s. 7½d., and Borax Consolidated slightly higher at 37s. 9d., the latter on market expectations that the dividend is likely to be maintained at 7½ per cent. General Refractories 10s. shares have kept steady at 17s. 4½d., and Radiation have been active up to 61s. 9d. Elsewhere, International Combustion shares rose further to £7½, and Babcock & Wilcox were 54s. 9d., with Ruston & Hornsby firm at 50s., Metal Box 91s. 3d., Amalgamated Metal 17s. 9d., and Imperial Smelting 13s. 9d. Elsewhere, Murex moved higher at 102s. 6d., as did J. Brockhouse at 80s. 9d., while Triplex Glass were 45s. 6d.

De La Rue rose to 198s. 9d. on the latest developments announced by the company's plastics subsidiary. In other directions, British Industrial Plastics 2s. shares eased to 6s. 9d. on the results, although the dividend is being maintained at 8 per cent. Erinoid 5s. ordinary were 12s. 3d., and Lacrinoid Products 2s. shares 5s. 4½d. Shares of companies mainly identified with the radio industry have been active at higher prices on the indications of extension of their interests to the plastics and other activities. Paint shares were inclined to improve, with Lewis Berger 108s., Paripan 32s., and Pinchin Johnson 40s. 6d. on market hopes that the results may show further recovery in the rate of dividend. Firmness at 90s. was shown in Birmid Indus-

tries, while Firth Brown improved to 77s. 6d. in iron and steels, with Stewarts & Lloyds 58s., Consett Iron 6s. 8d. units 8s. 9d., Guest Keen 39s. 9d., and United Steel 26s. 6d.

Following the meeting, British Celanese have been steadier around 36s. Courtaulds were 58s., Bradford Dyers rose to 26s. 9d. on market hopes of a small improvement in the dividend, while Bleachers were 14s. 6d., and Calico Printers 19s. 3d. Barry & Staines were again higher at 52s. 3d., with Nairn & Greenwich firm at 77s. 6d. on the full results. General Electric moved higher to 100s. 6d., also English Electric to 58s. and Crompton Parkinson to 34s. 4½d., with Ever Ready 44s. 3d., and Associated Electrical 58s. 3d., while Westinghouse firmed up to 76s. pending the dividend announcement. In other directions, Boots Drug have been firm at 55s. 9d., with Timothy Whites 42s., Beechams deferred 19s. 1½d., and Sangers 31s. Gas Light & Coke ordinary showed steadiness at 22s. 10½d. Wall Paper Manufacturers deferred were 44s. 3d., Goodlass Wall 10s. ordinary 18s. 10½d., and British Plaster Board higher at 41s. 6d., with Associated Cement firmer at 62s. 6d.

United Glass Bottle ordinary kept firm at 72s. 6d., showing only a small yield on the 12 per cent. to which the dividend has long been limited. Forster's Glass 10s. ordinary were 36s., and Canning Town Glass 5s. ordinary 9s. 6d. British Tar Products 5s. shares were more active, changing hands up to 11s.

British Chemical Prices

Market Reports

A STEADY trade in the London general chemicals market is reported this week and fresh buying interest has been in evidence in several sections of the market. Delivery specifications during the week have covered good volumes and the price position throughout the market remains firm. The demand for the soda products continues on a good scale with offers of yellow prussiate of soda very scarce. Chlorate of soda is not available in large quantities and hyposulphite of soda is in steady call. Pressure for deliveries of acetate of soda and percarbonate of soda is reported, while Glauber salt and salt cake are attracing fair attention. In the potash section, offers of solid caustic potash are finding a ready outlet and buying interest in acid phosphate of potash has been on active lines. Yellow prussiate of potash is firm with offers restricted. Among the miscellaneous chemicals, demand for peroxide of hydrogen has been fairly active with prices unaltered, and no change is reported in formaldehyde, which is moving steadily into consumption. Borax and powdered arsenic are active sections of the market. Activity in the coal-tar products market has been on a moderate scale and a fair amount of fresh inquiry is reported.

MANCHESTER.—Fresh inquiry on the Manchester market during the past week has resulted in a fair amount of new business being placed in a wide range of heavy chemicals and contract deliveries generally are going forward on a steady scale. So far as prices are concerned there has been no indication of easiness in any direction and here and there a further stiffening has occurred. Pretty well all the alkalies and the heavy acids are moving into consumption in good quantities, and there is a fairly steady consumption of a wide range of other products. On the whole, trade in the fertilisers is developing satisfactorily, though except in one or two directions it cannot be described as active. Among the by-products crude tar, creosote oil, carbolic acid, and benzol are in good demand at the controlled levels.

GLASGOW.—In the Scottish heavy chemical trade during the past week there has been an improvement in home trade. Export inquiries remain rather restricted. Prices keep very firm. There have been advances in the prices of a number of commodities since the beginning of 1945.

Price Changes

Barium Carbonate.—Precip., 4-ton lots, £19 per ton; 2-ton lots, £19 5s. per ton d/d.

WANTED.—Supplies of Nitre Cake in ten-ton lots. Box No. 2126 THE CHEMICAL AGE, 154, Fleet Street, E.C.4.

WANTED—Volumes 2, 3, 4, 5, 9 and 10 of Mellors Comprehensive Treatise on Inorganic and Physical Chemistry. Box. No. 2189, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

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